

Bartschia (*Agassitula*) *peartae*, a new species of colubrariid (Gastropoda: Colubrariidae) from the tropical western Atlantic

M. G. Harasewych

Department of Invertebrate Zoology
National Museum of Natural History
Smithsonian Institution
P.O. Box 37012
Washington, DC 20013-7012 USA
Harasewych@si.edu

ABSTRACT

A new western Atlantic species belonging to the “*Metula*” group is described and assigned to the subgenus *Agassitula*, which is provisionally included in the genus *Bartschia*. This new species, *Bartschia* (*Agassitula*) *peartae*, is larger, thinner, more fusiform, and more densely pigmented than other western Atlantic members of the “*Metula*” group.

Additional Keywords: “*Metula*” group, protoconch, larval development

INTRODUCTION

The genus *Metula* (H. and A. Adams, 1853:84) was first proposed to include four deep-water buccinoidean species with fusiform, finely cancellated shells. Kobelt (1876: 38–39) subsequently designated *Buccinum clathratum* A. Adams and Reeve, 1850, as the type species. As detailed in a review by Emerson (1986), the type locality originally reported as off South Africa was erroneous and had been corrected by Tomlin (1927: 160), who concluded that the type material came from the Pacific coast of Colombia. Emerson (1986: 27) also noted that the binomen *Buccinum clathratum* had previously been used by both Kiener (1834: 101) and Anton (1839: 91), and that *Metula amosi* Vanatta, 1913 is the oldest available name for the type species of *Metula*.

As the number of species described as *Metula* has increased (> 40 Recent and fossil species), they have been variously apportioned among several supraspecific taxa (Table 1) that have been proposed, synonymized, or transferred between the families Buccinidae and Colubrariidae largely based on interpretations of shell morphology.

Several of these supraspecific taxa have been referred to the family Colubrariidae on the basis of anatomical studies (e.g., Ponder, 1974: 328; Vermeij, 2001: 297), but most subsequent authors (e.g., Olsson and Bayer, 1972; Kilburn, 1975; Houbbrick, 1984; Emerson, 1986; Beu and Maxwell, 1987) concurred with Cernohorsky (1971), plac-

ing *Metula* and related genera in the subfamily Pisaniinae of the Buccinidae. A recent molecular study (Óliverio and Modica, 2009: 794, figs. 5, 6) included *Metula amosi*, the type species of *Metula*, within a strongly supported clade as the sister taxon to four species of *Colubraria*, confirming its placement within Colubrariidae.

Among the specimens collected in the Bahamas using the DSV JOHNSON-SEA-LINK research submersibles over the past several decades were three crabbed individuals of a distinctive new species most similar to *Metula agassizi* Clench and Aguayo, 1941, the type species of *Agassitula* Olson and Bayer, 1972. More recently, an additional crabbed specimen was collected in traps off the southwestern coast of the Dominican Republic. This new species is described herein, and provisionally assigned to *Agassitula*, which had been proposed as a subgenus of *Metula*, and subsequently synonymized with both *Metula* (Bouchet, 2014) and *Bartschia* Rehder, 1943 (Beu and Maxwell, 1987: 62). *Bartschia* has been recognized as a genus by some authors (Bayer and Olsson, 1972: 924; Beu and Maxwell, 1987: 62; Garcia, 2008:144), but considered to be a subgenus of *Metula* by others (Bouchet, 1988; Bozzetti, 1993).

A revision of the systematics of this large and complex lineage within Colubrariidae is clearly needed. In the interim, data are provided that serve to distinguish *Bartschia* from *Metula*, and to differentiate *Bartschia* from *Agassitula*.

SYSTEMATICS

Family Colubrariidae Dall, 1904

Genus *Bartschia* Rehder, 1943

Type species, by original designation, *Bartschia significans* Rehder, 1943.

Diagnosis: Shell (Figures 17–19) large for the family (to 55 mm), solid, with elevated conical spire, evenly rounded whorls lacking a shoulder, and a short, broad,

Table 1. Supraspecific taxa related to *Metula* in the chronological order.

<i>Metula</i> H. and A. Adams, 1853. Type species, by subsequent designation of Kobelt (1976), <i>Buccinum clathratum</i> A. Adams and Reeve, 1850 [not <i>Buccinum clathratum</i> Kiener (1934:101) or Anton (1839:91)] = <i>Metula amosi</i> Vanatta, 1913. Recent, eastern Pacific.
<i>Acaemtochetus</i> Cossmann, 1901. Type species, by original designation, <i>Murex mitraeformis</i> , Brocchi, 1814. Mio-Pliocene Italy. = <i>Metula</i> (Emerson, 1986:27; Beu and Maxwell, 1987:62).
<i>Antimitra</i> Iredale, 1917. Type species, by original designation, <i>Pleurotoma aegrota</i> Reeve, 1845. Recent. Singapore. = <i>Metula</i> (Kilburn, 2004: 269).
<i>Antemetula</i> Rehder, 1943. Type species, by original designation, <i>Buccinum metula</i> Hinds, 1944. = <i>Acaemtochetus</i> (Cernohorsky, 1971:151), = <i>Metula</i> (Emerson, 1986:27; Beu and Maxwell, 1987:62).
<i>Bartschia</i> Rehder, 1943. Type species, by original designation, <i>Bartschia significans</i> Rehder, 1943. Recent, Florida Keys. = <i>Metula</i> (<i>Bartschia</i>) (Bouchet, 1988:150; Bozzetti, 1993:111); = <i>Bartschia</i> (Beu and Maxwell, 1987: 62; García, 2008:144).
<i>Kanamaria</i> Kuroda, 1951: 59–70. Type species, by original designation, <i>Colus (Aulacofusus) adonis</i> Dall, 1919. Recent, Japan. [Originally described as a subgenus of <i>Metula</i> , transferred to Colubrariidae by Fraussen and Lamy (2008).]
<i>Colubrarina</i> Kuroda and Habe in Kuroda, Habe and Oyama, 1971. Type species by original designation, <i>Antemetula (Colubrarina) metulina</i> Kuroda and Habe in Kuroda, Habe and Oyama, 1971. Recent, NW Pacific. = <i>Metula</i> (Emerson, 1986:27; Beu and Maxwell, 1987:62).
<i>Minitula</i> Olsson and Bayer, 1972. Type species, by original designation, <i>Metula (Minitula) minor</i> Olsson and Bayer, 1972. Pliocene, Florida. ? = Columbellidae (Beu and Maxwell, 1987:62).
<i>Agassitula</i> Olsson and Bayer, 1972. Type species, by original designation, <i>Metula agassizi</i> Clench and Aguayo, 1941. = <i>Acaemtochetus</i> (<i>Agassitula</i>) (Houbrick, 1984: 423); = <i>Metula</i> (Bouchet, 2014); = <i>Bartschia</i> (Beu and Maxwell, 1987:62).
<i>Floritula</i> Olsson and Bayer, 1972. Type species, by original designation, <i>Metula robertsi</i> Olsson, 1967. Pliocene, Florida. = <i>Metula</i> (Beu and Maxwell, 1987:62).
<i>Caseyella</i> MacNeil in MacNeil and Dockery, 1984. Type species, by original designation, <i>Metula (Caseyella) neptuneiformis</i> MacNeil in MacNeil and Dockery, 1984. Oligocene, SE United States. = <i>Bartschia</i> (Beu and Maxwell, 1987:62).

dorsally deflected siphonal canal that crosses the coiling axis of shell. Protoconch (Figures 26, 27) large, dome-shaped, increases in diameter from 223 μ m to 2.4 mm in $3\frac{1}{4}$ smooth, evenly rounded whorls. Transition to teleoconch distinct, marked by onset of 8 spiral cords, followed after $\frac{1}{4}$ whorl by appearance of axial riblets (~ 30 per whorl). Suture adpressed. Spiral sculpture of rounded cords that intersect with opisthocline axial riblets of similar prominence on early whorls, producing a cancellated pattern. Spiral cords become stronger than axial riblets after 4th teleoconch whorl. Aperture oval, broad, about $\frac{1}{2}$ shell length; anal canal accentuated by thickening along posterior region of outer lip. Outer lip with thickened varix with short denticles, most pronounced along central portion. Parietal region and columella with thick callus. Shell base color whitish yellow, with 4 bands of chestnut brown maculations at the suture, shell periphery, anterior to shell periphery, and along tip of siphonal canal. Aperture white.

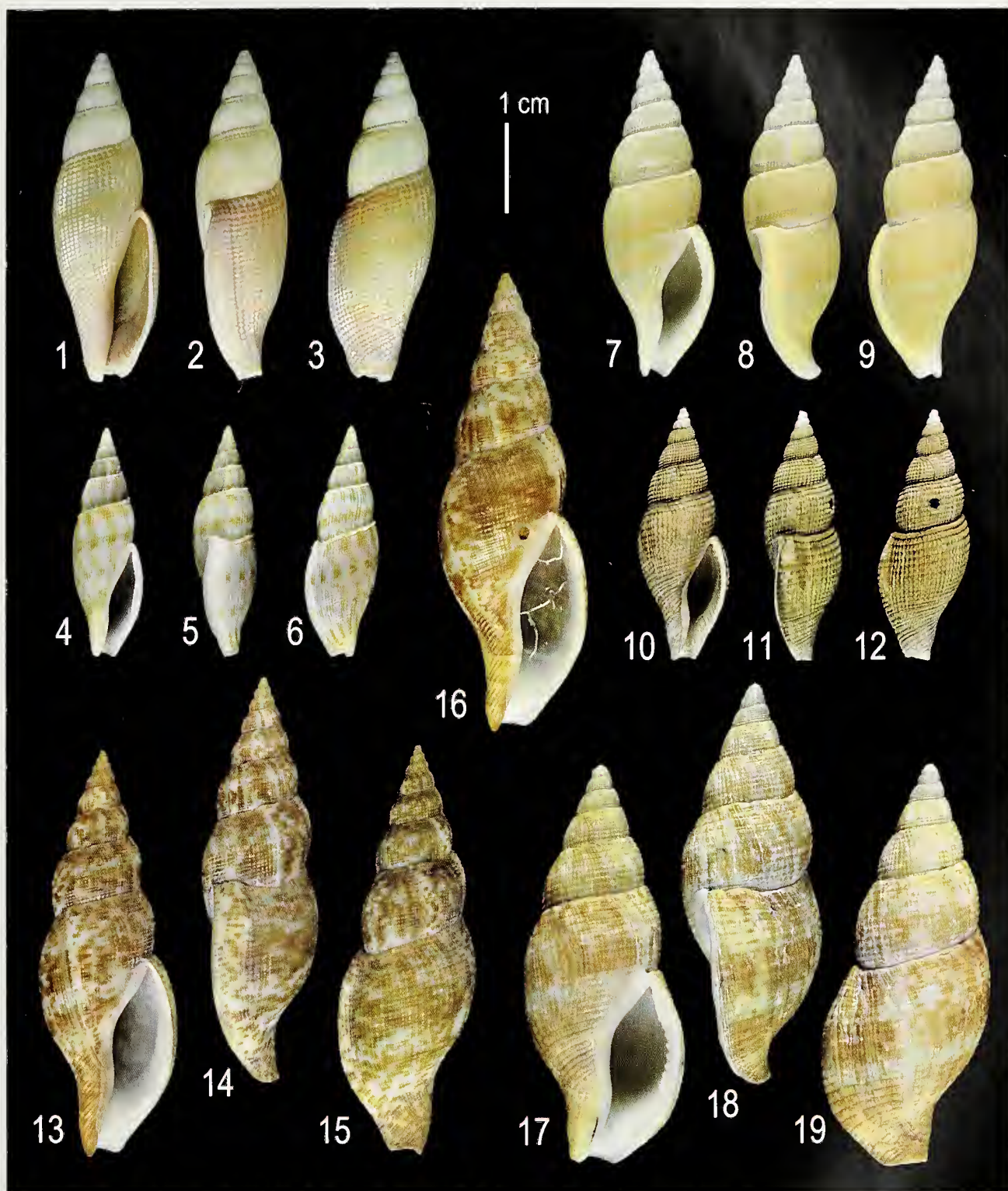
Remarks: *Bartschia* may be readily distinguished from *Metula* (Figures 1–3), as exemplified by their respective type species, in having a proportionally broader shell with more evenly rounded whorls, a shorter, wider aperture with more pronounced denticles along the outer lip, slightly coarser sculpture with spiral cords dominant, and a color pattern consisting of four spiral brown bands. The spiral cord bordering the suture is not enlarged. The protoconch of *Bartschia* is diagnostic in being dome-shaped and consisting of $3\frac{1}{4}$ smooth, rounded whorls that increase in diameter tenfold from first to last whorl (Table 2).

Subgenus *Agassitula* Olsson and Bayer, 1972

Agassitula Olsson and Bayer, 1972. Type species, by original designation, *Metula agassizi* Clench and Aguayo, 1941.

Diagnosis: Shell (Figures 7–9) of moderate size for the family (to 39 mm), solid, with tall, elongated, conical spire (about $\frac{1}{2}$ shell length), evenly rounded whorls, narrow aperture, and a long, slender, attenuated, dorsally reflected siphonal canal that crosses the coiling axis of shell. Protoconch (Figures 22, 23) increases in diameter from 350 μ m to 1.5 mm in about 2 smooth, glassy whorls. Transition to teleoconch distinct, marked by onset of 4–5 spiral cords, followed within $\frac{1}{4}$ whorl by axial riblets. Suture adpressed. Sculpture of weaker rounded spiral cords and stronger opisthocline axial riblets intersecting to produce a cancellated pattern. Ribs and cords of equal strength by 5th teleoconch whorl. Aperture oval, generally broadest posterior to midpoint. Outer lip thickened to produce sinuate varix, lined with short denticles. Shell color ivory, with traces of 4 brownish spiral bands in some specimens.

Remarks: *Agassitula* (Figs. 7–16) may be distinguished from *Bartschia* (Figs. 17–19) and *Metula* (Figs. 1–6) in having a more elongated shell with a spire that is generally equal to or greater than half the shell length, an ovate aperture, and a more elongated siphonal canal that is distally attenuated and recurved. Pigmentation is variable. The four bands may be barely discernible, or pronounced to the point of overlapping. The



Figures 1–19. Shells of *Metula* and *Bartschia* species. 1–3. *Metula amosi* Vanatta, 1913, USNM 518256, dredged in Panama Bay, Panama. 4–6. *Metula metula* (Hinds, 1844), USNM 824614, Tayabas Bay, Marinduque, Philippine Islands, trawled in deep water. 7–9. *Bartschia* (*Agassitula*) *agassizi* (Clench and Aguayo, 1941), USNM 810504, 5 miles NE of Alicetown, North Bimini, Bahamas, in 45–115 fms, R/V SILVER BAY sta. 2488. 10–12. *Bartschia* (*Agassitula*) *guppyi* Olsson and Bayer, 1972, holotype, USNM 706729, off Bocas de Drago, NW of Trinidad, in 137–143 m, R/V PILLSBURY Sta. P-849. 13–16. *Bartschia* (*Agassitula*) *peartae* new species. 13–15. Holotype, USNM 1004131. 16. Paratype 1, both off Fernandez Bay, San Salvador, Bahamas, in 271 m, DSV JOHNSON-SEA-LINK 1 sta. JSL-I-2328. 17–19. *Bartschia significans* Rehder, 1943, holotype, USNM 516493, dredged off the Dry Tortugas, Florida Keys. 1 cm scale bar applies to all images.

Table 2. Measurements of illustrated specimens. AL = Aperture length; AW = aperture width; SL = shell length; SW = Shell width. D initial = initial diameter of the protoconch; D final = final diameter of the protoconch.

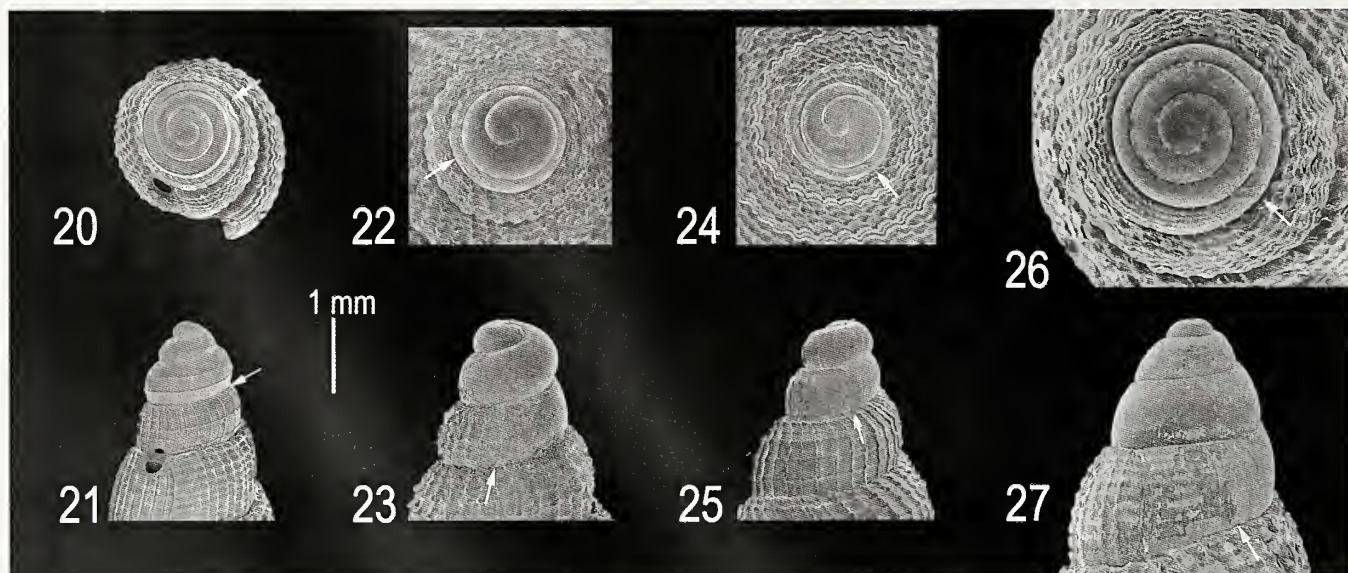
	<i>Metula amosi</i>	<i>Metula metula</i>	<i>Agassitula agassizi</i>	<i>Agassitula peartae</i> n. sp.	<i>Bartschia significans</i>
AL/SL	0.503	0.521	0.492	0.517	0.519
SW/SL	0.314	0.312	0.342	0.334	0.401
AW/AL	0.279	0.277	0.351	0.494	0.380
Protoconch D initial	?	361 μ m	350 μ m	286 μ m	223 μ m
Protoconch D final	?	1.3 mm	1.5 mm	1.3 mm	2.4 mm
Protoconch # whorls	?	2½	2	1¾	3¼

protoconch of *Agassitula* most closely resembles that of *Metula amosi* (as extrapolated from incompletely preserved examples) in size, shape and number of whorls, but these both differ from Indo-Pacific species attributed to *Metula* (Figs. 4–6, 20–21).

***Bartschia (Agassitula) peartae* new species**
(Figures 13–16, 26–27)

Description: Shell (Figures 13–16) large for genus (to 71 mm), thin, biconical, fusiform, with tall, narrow spire (spire angle 28–34°) comprising more than ½ total shell length. Protoconch (Figures 24–25) increasing in diameter from 268 μ m to 1.3 mm in 1¾ glassy, rounded whorls, with fine axial growth striae near teleoconch. Transition to teleoconch (Figures 24–25, arrows) marked by formation of incised suture and 3 broad spiral cords (apical most prominent and first to be formed) followed by axial ribs that become stronger and more regularly spaced within ¼ whorl. Teleoconch with up to 8 evenly rounded, convex whorls without distinct shoulder, with periodic

thickened varices beginning on third teleoconch whorl, occurring every ¾–1 whorl thereafter. Suture adpressed by third teleoconch whorl. Spiral sculpture of 35–37 rounded cords on last whorl; 13–15 cords on siphonal canal, and 21–23 on penultimate whorl, intersecting with similarly spaced, slightly curved, opisthocline axial ribs (67–70 on final whorl) to produce a finely reticulated pattern of squarish nodes over the surface of the shell. Spiral sculpture more prominent on early whorls; axial sculpture slightly dominant on later whorls. Aperture large, narrow, deflected from coiling axis by 9–11°, with a weakly delimited anal canal. Outer lip with narrow, thickened, rounded varix with 23–26 short denticles, sharpest posteriorly, becoming broader, more rounded and less distinct anteriorly, absent along siphonal canal. Parietal callus thin along inductura, slightly thicker along smooth, axial columella. Siphonal canal long, broad, open, deflected dorsally and adaxially, without forming fasciole or pseudoumbilicus. Shell base color white to light tan, with numerous small, elongated golden brown spots coalescing to form irregular, mottled patterns that



Figures 20–27. Scanning electron micrographs (apical and lateral views) of the protoconchs of: **20–21.** *Metula metula* (Hinds, 1844), USNM 279906, Butung Strait, 6.5 miles SE of Tikola Peninsula, Sulawesi, Indonesia, trawled in 68 m. **22–23.** *Bartschia (Agassitula) agassizi* (Clench and Aguayo, 1941) (Specimen in figures 7–9). **24–25.** *Bartschia (Agassitula) peartae* new species, holotype, USNM 1004131. **26–27.** *Bartschia significans* Rehder, 1943, USNM 450812, RV Eolis sta. 323, 110 fms, off Sand Key, Florida, 1916. 1 mm scale bar applies to all images. Arrows indicate transition from protoconch to teleoconch.

are darkest and densest in four spiral bands, the widest along the shell periphery. Aperture white along periphery, brownish interiorly (as a result of its being translucent.)

Type Locality: Off Fernandez Bay, San Salvador, Bahamas (24° 1.7' N, 74° 32.65' W), in 271 m, DSV JOHNSON-SEA-LINK I, sta. JSL-I-2328.

Type Material: Holotype, USNM 1004131, Paratypes 1–2, USNM 1250297, from the type locality; Paratype 3, G. Everson collection, off Isla Beata, southwestern coast of the Dominican Republic, in trap in 61–122 m.

Distribution: This species is presently known from the central Bahamas and the SW coast of the Dominican Republic, at depths from 61–271 m.

Etymology: This species is named in honor of Ms. Marie Peart, in recognition of her contributions and service to The Bailey-Matthews National Shell Museum.

Comparative Remarks: Although much larger in size, the shape of this species most closely resembles *Metula miocenica* Schmeltz and Portell, 2003, from the Miocene Chipola Formation of Northern Florida, and the Recent *Bartschia* (*Agassitula*) *agassizi*, from comparable depths off Florida and Cuba. It differs from both in having a thinner shell, with much finer surface sculpture and weaker dentition along the outer lip. The coloration of this new species approximates that of *Bartschia significans* and to a lesser degree *Metula metula* (Hinds, 1844) (Figures 4–6). From the former, it differs in having a more fusiform shell with a proportionally taller spire, and finer, more evenly cancellated sculpture. From the latter, it differs in its larger size, more diffuse coloration, and the lack of an enlarged spiral cord along the suture. It may easily be distinguished from both on the basis of significant differences in protoconch morphology. The protoconch of *Bartschia* (*Agassitula*) *peartae* (Figures 24–25) is far smaller and has fewer whorls than that of *Bartschia* (*Bartschia*) *significans* (Figures 26–27). Although more similar in size to the protoconch of *Metula metula* (Figures 20–21), it lacks the pustules on the first half whorl and subsequent spiral threads present on the protoconch of that species.

DISCUSSION

Members of the “*Metula*” group (loosely defined as species described in or subsequently referred to one of the supraspecific taxa listed in Table 1) inhabit subtidal to bathyal soft bottom substrates in tropical and temperate oceans. Most are relatively rare in collections and known only from their shells. Radulae have been described for few species (Bouchet, 1988; Ponder, 1974). In addition to the molecular studies of Oliverio and Modica (2009, see above), Kantor et al. (2013: 2) included sequences of *Metula* sp., which served as an outgroup in their studies of deep-sea wood-dwelling buccinids.

Much work remains to be done to unravel the relationships among these many taxa, a task made more difficult by the paucity of anatomical and molecular material. Although the majority of examined specimens had protoconchs that were either worn or broken, there is nevertheless considerable variation in protoconch morphology among the many species included in this group. Altena (1949: figs. 1–7) made use of distinctive protoconch morphologies to distinguish species and lineages of Indo-Pacific taxa and speculated that they differed considerably in their larval ecology.

The protoconch of *B. significans* differs from those of other members of the *Metula* group in having a smaller initial diameter (indicating a smaller egg size) that increases tenfold prior to metamorphosis (suggesting the presence of nurse eggs in the egg capsule). This species appears to have a limited geographical range compared to species of *Agassitula*, which have a protoconch typical of species with direct development. Protoconch morphology of *Metula metula* and some of the species treated by Altena as *Antemetula* indicates a planktonic larval stage for some Indo-Pacific taxa.

ACKNOWLEDGMENTS

I thank Gene Everson, of Louisville, Kentucky, for providing photographs and information about the specimen in his collection, which is paratype 3. The assistance of Yolanda Villacampa with the Scanning Electron Micrographs is gratefully acknowledged.

LITERATURE CITED

- Adams, H. and A. Adams, 1853. The Genera of Recent Mollusca; arranged according to their organization. John van Voorst, London, vol. 1: 1–256, pls. 1–32.
- Adams, A. and L. Reeve, 1850. Mollusca, pt. 2:25–44, pls. 10–17. In: The Zoology of the Voyage of H. M. W. “Samarang”, under the command of Captain Sir Edward Belcher during the years 1843–1846. Reeve and Benham, London.
- Altena, C.O. van R. 1949. The genus *Antemetula* Rehder in the Indo-west Pacific Area, with the description of two new fossil species. *Bijdragen tot de Dierkunde* 29: 385–393.
- Anton, H.E. 1839. Verzeichniss der Conchylien welche sich in der Sammlung von Hermann Eduard Anton befinden. Anton, Halle, xvi + 110 pp.
- Beu A.G. and P.A. Maxwell 1987. A revision of the fossil and living gastropods related to *Plesiotriton* Fischer, 1884 (Family Cancellariidae, Subfamily Plesiotritoninae n. subfam.). With an appendix: Genera of Buccinidae Pisaniinae related to *Colubraria* Schumacher, 1817. *New Zealand Geological Survey Paleontological Bulletin* 54: 1–140.
- Bouchet, P. 1988. Two new species of *Metula* (Gastropoda: Buccinidae) with a description of the radula of the genus. *The Nautilus* 102: 149–153.
- Bouchet, P. 2014. *Agassitula* Olsson & Bayer, 1972. Accessed through: World Register of Marine Species at <http://www.marinespecies.org/aphia.php?p=taxdetails&id=527523> on 2014-07-06

- Bozzetti, L. 1993. Description of a new species of the genus *Metula* H. & A. Adams, 1853 (Gastropoda, Prosobranchia, Buccinidae) from the western Indian Ocean. *Apex* 8: 111–113.
- Cernohorsky, W.O. 1971. Indo-Pacific Pisaniinae (Mollusca: Gastropoda) and related buccinid genera. *Records of the Auckland Institute and Museum* 8: 137–167.
- Clench, W.J. and C.G. Aguayo. 1941. Notes and descriptions of new deep-water Mollusca obtained by the Harvard-Havana Expedition off Cuba. IV. *Memorias de la Sociedad Cubana de Historia Natural "Felipe Poey"* 15: 177–180, pl. 14.
- Cossmann, M. 1901. *Essais de paléonconchologie comparée*. 4. Cossmann, Paris, 293 pp., 10 pls.
- Emerson, W.K. 1986. On the type species of *Metula* H. & A. Adams, 1853. *Buccinum clathratum* A. Adams and Reeve, 1850 (Gastropoda: Buccinidae). *The Nautilus* 100: 27–30.
- Fraussen K. and D. Lamy, 2008. Revision of the genus *Kanamaria* Kuroda, 1951 (Gastropoda: Colubrariidae) with the description of two new species. *Novapex* 9: 129–140.
- García, E.F. 2008. Four new buccinid species (Gastropoda: Buccinidae) from the western Atlantic. *Novapex* 9: 141–148.
- Hinds, R.B. 1844–45. The zoology of the voyage of H.M.S. *Sulphur*: under the command of Captain Sir Edward Belcher, R.N., C.B., F.R.G.S., etc., during the years 1836–42. Vol. II, Mollusca. Smith, Elder and Co., London, v + 72 pp., 21 pls.
- Houlbrick, R.S. 1984. A new "*Metula*" species from the Indo-West Pacific (Prosobranchia: Buccinidae). *Proceedings of the Biological Society of Washington* 97: 420–424.
- Iredale, E.T. 1917. More molluscan name changes, generic and specific. *Proceedings of the Malacological Society of London* 12: 322–330.
- Kantor, Y.I., N. Puillandre, K. Fraussen, A.E. Fedosov, and P. Bouchet, 2013. Deep-water Buccinidae (Gastropoda: Neogastropoda) from sunken wood, vents and seeps: molecular phylogeny and taxonomy. *Journal of the Marine Biological Association of the United Kingdom* 93: 2177–2195.
- Kiener, L.C. 1834. *Spécies Général et iconographie des coquilles vivantes. Genre Buccin*. J. B. Ballière, Paris, 9, 108 pp., 29 pls.
- Kilburn, R.N. 1975. Taxonomic notes on South African marine Mollusca (5): including description of new taxa of Rissoiidae, Cerithiidae, Tonniidae, Cassididae, Buccinidae, Fascioliariidae, Turbinellidae, Turridae, Architectonicidae, Epitoniidae, Limidae and Thraciidae. *Annals of the Natal Museum* 22: 592–595, pl. 10.
- Kilburn R.N. 2004. The identities of *Otitoma* and *Antimitra* (Mollusca: Gastropoda: Conidae and Buccinidae). *African Invertebrates* 45: 263–270.
- Kobelt, W. 1876. *Illustrirtes Conchylienbuch*. Bauer and Raspe, Nürnberg, vol. 1, pp. 1–40, pls. 1–10.
- Kuroda, T., 1951. Descriptions of a new genus of a marine gastropod, *Kanamaria* gen. n., and a new species of a bivalve, *Abra kanamarui*, sp. n., dedicated to Mr. T. Kanamaru on his 60th birthday (The Celebration Number of Mr. T. Kanamaru's 60th Birthday). *Venus* 16: 68–72.
- Kuroda, T., T. Habe, and K. Oyama. 1971. The Sea Shells of Sagami Bay, collected by His Majesty The Emperor of Japan. Maruzen, Tokyo. 741 pp. [Japanese text] + 121 pls. + 489 pp. [English text] + 51 pp. [index] + map.
- MacNeil, F.S. and D.T. Dockery, III. 1984. Lower Oligocene Gastropoda, Scaphopoda and Cephalopoda of the Vicksburg Group in Mississippi. *Mississippi Department of Natural Resources, Bureau of Geology, Bulletin* 124: 415 pp. + 72 pls.
- Oliverio, M. and M.V. Modica. 2009. Relationships of the haematophagous marine snail *Colubraria* (Rachiglossa: Colubrariidae), within the neogastropod phylogenetic framework. *Zoological Journal of the Linnean Society* 158: 779–800.
- Olsson, A.A. and F.M. Bayer. 1972. American *Metulas* (Gastropoda: Buccinidae). *Bulletin of Marine Science* 22: 900–925.
- Ponder, W.F. 1974. The Origin and Evolution of the Neogastropoda. *Malacologia* 12: 295–338.
- Behder, H.A. 1943. New Marine Mollusks from the Antillean Region. *Proceedings of the United States National Museum* 93(3161): 187–203, pls. 19–20.
- Schmeltz, G.W. and R.W. Portell, 2003. A new species of *Metula* (Gastropoda: Colubrariidae) from the Lower Miocene Chipola Formation of Florida. *The Nautilus* 117: 12–14.
- Tomlin, J.R. le B. 1927. The Mollusca of the "St. George" Expedition. *Journal of Conchology*, 18: 153–170.
- Vanatta, E.G. 1913. Descriptions of new species of marine shells. *Proceedings of the Academy of Natural Sciences of Philadelphia* 65: 22–27, pl. 2.
- Verneij, G.J. 2001. Taxonomy, distribution and characters of the pre-Oligocene members of the *Cantharus* group of Pisaniinae (Neogastropoda: Buccinidae). *Journal of Paleontology* 75: 295–309, 1 pl.